Space Weather Forecast

Issued on Thursday, 08 June 2023 at 13:06 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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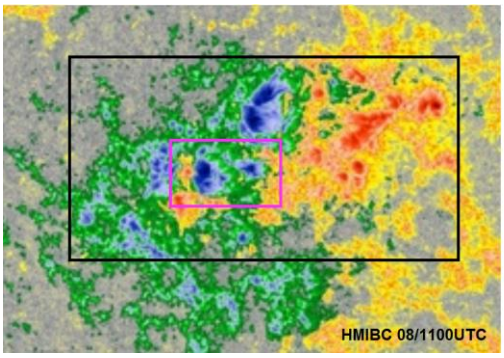
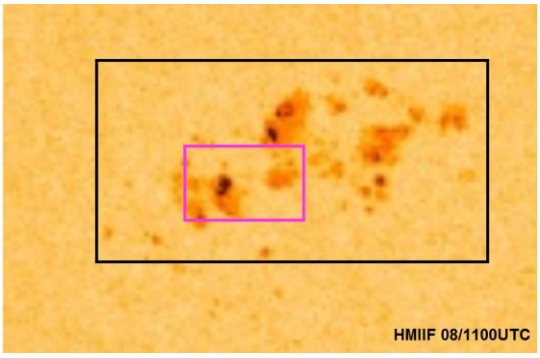
Space Weather Forecast Headline: Chance of Moderate-class X-ray flares (R1/Minor-R2/Moderate radio blackouts). Slight chance of G1/Minor Geomagnetic Storms.

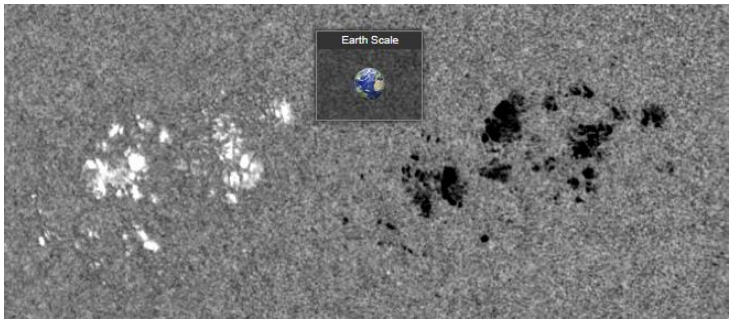
Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been moderate over the last 24 hours, with a middle-ranking Moderate-class X-ray flare observed immediately prior to this reporting period that was ongoing beyond 07/1200UTC. The sunspot region responsible for this event and some upper-end Common-class flares was the largest and most dynamic on the Sun in the period. This spot group as a whole underwent areal growth, and also saw an emerging new large spot in its centre. This sunspot region was one of up to nine on the current facing side of the Sun, although activity and development in other groups was more subtle, with no significant activity observed.

Figure 1: Magnetic and visible satellite imagery of the largest and most complex sunspot region in the southeast, showing a possibly unstable configuration of closely aligned opposing polarities within the same spot boxed in magenta. Also shown below is a 24-hour evolution in this group's footprit in black and white magnetic imagery, showing marked growth of an intermediate spot (compare white footprint from 07/100UTC with black from 08/1100UTC). Growth is generally a sign of increased propensity to flare. Image processing courtesy of Helioviewer.org. Earth shown for scale.







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A pair of 'prominences' lifted off in the period (arcs of plasma from the edge of the facing side of the Sun) - one from the vicinity of a sunspot group in the southeast at 07/2000UTC, and the second from high latitude in the northeast at 08/0900UTC. Neither of these is expected to affect Earth. A 'filament' disappeared from the northeast at 08/0900UTC (separately to the aforementioned prominence), however there is not yet any evidence of any resulting interplanetary Coronal Mass Ejection (CME).

Satellite imagery for the period shows a slow eastward-heading CME of uncertain provenance in the current UTC morning. Modelling results are awaited, however a hit appears unlikely given the parameters submitted. All other CMEs noted appeared to have eastward (behind Earth in the track of its orbit) or else far-sided solutions in modelling, with no effects expected.

Solar Wind / Geomagnetic Activity: Solar wind parameters showed a slow regime in the main, however a possible weak CME was observed around 07/2230UTC, which may be the shock from the awaited glance from the 04 June CME. The solar wind speed was nevertheless at background levels, with minor staged increases around 07/2230UTC and again around the turn of the UTC day, with a slow waning trend then setting in. The number of particles in the solar wind was within Background levels throughout, while their associated magnetic field was steady at first, rising to a Slightly Elevated peak with the CME before also waning. The north-south component of the solar wind magnetic field was small-scale and erratic, albeit with a gradual drift to become more reliably anti-aligned with Earth's field later in the current UTC morning.

The net effect of the above solar wind measures was for provisionally quiet geomagnetic activity throughout.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a daily chance of moderate solar activity. Any significant flares are most likely to originate from the largest sunspot group. The risk of flares should fall very slightly from day two, Friday 09 June, as a front-sided group leaves the facing side, with no major returning regions due to compensate.

Solar Wind / Geomagnetic Activity: The most likely CME to feature in geomagnetic activity may have already arrived, with the 04 June southwest 'filament' perhaps showing as the 07/2230UTC enhancement. Should this still be outstanding, there remains a slight chance of G1 within day one, however this now appears less likely, and the 04 June CME appears to have peaked. More marginal impacts from further CMEs are possible but not expected on days 3 and 4 (UTC weekend).

Otherwise, ambient solar winds are expected to become slightly elevated or elevated on days 3 and 4 due to the arrival of coronal hole fast winds.

There is a slight chance of Minor Geomagnetic Storm G1, peaking on day one should the CME from 04 June remain in transit, with a secondary peak then due on Saturday 11 June from a more reliable fast wind. Activity should be most reliably quiet on Friday 09 June between these events.

Energetic Particles / Solar Radiation: Solar radiation storms are not expected, however there is a very slight chance of reaching the S1/Minor Storm threshold should any larger X-ray flares occur.

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Met Office Space Weather Forecast

Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	5	20	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	50	40	40	40
Very Active	R3 to R5 X	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	5	10	10	10
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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